DRAFT

Appendix A – Criteria for evaluating indicators

Indicators must be used and useful to scientists, policy makers and the public. Their selection should be based on explicit criteria to ensure consistency and widespread acceptance. Attention given to the development and use of criteria will further ensure the successful selection of appropriate indicators.[1]

The planning team will evaluate each potential indicator based on criteria recommended by the National Research Council, the principal operating agency of the National Academy of Sciences.[2] The planning team will use the following criteria for evaluating indicators:

General Importance

The indicator must be capable of telling a story of general importance about major environmental or socioeconomic change. The indicator must both have general applicability and serve as an indicator of a system or suite of species or conditions, or it must pertain to the condition of a particular species or condition of interest within the watershed.

Conceptual basis

To be useful, an indicator must be based on a well-understood and generally accepted conceptual model. An indicator is not likely to be useful unless it is based on a conceptual model of the system to which it is applied. The conceptual model provides the rationale for the indicator. Without a supporting model, an indicator's meaning remains unclear.

Reliability

An indicator must be reliable. The best evidence for the reliability of an indicator is its successful use previously. An indicator that is newly proposed lacks a historical record of reliability. Nevertheless, its reliability may be provisionally established if the indicator is based on a well-established scientific theory. The likelihood that data collection efforts will continue also is important to establish reliability of an indicator.

Scales of applicability

The temporal and spatial scales of the processes measured by an indicator need to be clear. It is important to understand whether the changes measured by an indicator are likely to be short-term, or long-term. The indicator must be sensitive enough to detect important changes but not so sensitive that signals are masked by natural variability. The explicit selection of spatial and temporal scales for indicators is essential.

Statistical properties

An indicator must be capable of detecting signals above the "noise" of normal environmental variation. The statistical properties must be understood well enough that changes in the values of an indicator will have clear and unambiguous meaning. Useful

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[1] National Research Council, Ecological Indicators for the Nation 51 (2000).

[2] National Research Council, Ecological Indicators for the Nation 52-58 (2000).

indicators should be able to distinguish between "normal" variation, and variation that falls outside what is expected given the historical and paleoecological record.

Data quality

It is important to understand how much and what kinds of information are necessary to permit reliable estimates of the indicator to be calculated. It also is important to understand how many and what kinds of data are required for the indicator to detect a trend. The underlying data must be accurate, and there must be clear documentation of sampling and analytical methodology so that future investigators understand exactly how each indicator was calculated. Data must be useful even as sampling and analytical technologies change.

Necessary skills

An indicator capable of commanding broad attention must be based on data that are accurate and, equally important, perceived by all interested parties to be accurate. It is difficult to gather support for the use of an indicator that depends on the collection of input data requiring highly technical, specialized knowledge if the data are to be accurate. Instead, it is desirable that indicators be designed to use input data that are relatively straightforward to gather.

Robustness

Robustness means that an indicator is relatively insensitive to expected sources of interference. An indicator is of little value if input data is likely to change, and the time series of measurements cannot be continued in compatible form.

Compatibility

An indicator must be compatible with indicators being developed in other regions and by other organizations.

Cost effectiveness

An important criteria for evaluation of an indicator is its cost effectiveness. The value of the information to be obtained must be greater than the cost of obtaining it. An indicator is not cost effective if the information it yields can be obtained for less cost in another way.

Indicators can be further categorized as leading indicators, coincident indicators and following indicators. An activity as it is occurring, and which have value to evaluate the predictions and to establish baseline conditions. Following indicators are those that measure in activity after it has occurred. Following indicators have no protective value, but can be used to identify trends.

Indicator level

Finally, indicators can be categorized as high-level or low-level indicators.

[Add linkage/ framework between levels of indicator.]